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ABSTRACT

This paper, commissioned for the development of the national report, "National Excellence: A Case for Developing America's Talent," analyzes the policies and practices for educating high-ability students in Japan, Taiwan, and China. It reports on studies over the past 11 years of East Asian children's academic achievement. In the first section, the report looks at governmental policies and practices concerning the education of three types of students: (1) those who display high levels of intelligence, (2) those who are talented in the arts, and (3) those who are high academic achievers. Special programs both in and out of school are described. In the second part, the report describes the characteristics of students who have participated in the authors' studies and compares their performance and personal characteristics with those of American peers. Discussion focuses on students who demonstrate high levels of cognitive ability and on students who display exceptional ability in mathematics. The paper notes that programs for gifted and talented children in East Asia are new; the majority, especially in China and Taiwan, established only during the last decade. Japan supports no programs specifically for gifted students prior to the high school level. There is a greater emphasis of East Asian cultures on effort, rather than ability. (Contains 16 references.) (DB)

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ED 372 582

Education of Gifted and Talented Students in China, Taiwan, and Japan

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Introduction

The stunning success of East Asian students in many forms of academic achievement has aroused a great deal of international interest. What are the educational and child-rearing practices that might help to explain why East Asian students, from kindergarten through high school, have been among the top performers in international studies of academic achievement and in international academic competitions? If the general level of academic achievement is so high, what are the students like who are at the top of their classes in East Asia? How do these students differ in ways other than academic achievement from average-performing peers in their own countries and from high achieving students in the West? The purpose of this paper is to explore these questions in two ways. First, we describe educational practices, especially those for gifted and talented students, in three locations in East Asia: China, Taiwan, and Japan. Second, we review data from a series of studies in which we have compared students in these three locations with students in the United States in terms of such characteristics as intelligence, beliefs, attitudes, and self-evaluations.

We know from the beginning that the outcome of our explorations will not be simple. Attitudes and beliefs about giftedness differ greatly among cultures. The degree to which different educational systems attempt to accommodate gifted and talented students also varies widely. We know, too, that variables such as economic investment in education, size of classes, and academic preparation of teachers are unlikely to give us a great deal of insight into the high levels of performance of gifted and talented students. Such variables have failed to clarify cross-national differences in academic achievement between students in East Asia and in the West, and are unlikely to help us understand why certain students in these cultures perform at such remarkably high levels.

Background of the Report

In the first section of this report we discuss governmental policies and practices concerning the education of three types of students: those who display high levels of intelligence, who are talented in the arts, and who are high achievers in their academic work. Information for this part of the report was obtained from interviews with leading educators, educational officials, and psychologists in each country. In the second part, we describe the characteristics of students who have participated in a series of studies we have conducted in Japan, Taiwan, and mainland China, and compare their performance and personal characteristics with those of their American peers. The discussion of these students focuses on students who demonstrate high levels of cognitive ability and on students who display exceptional ability in mathematics.

Interviews

During the summer of 1991, we interviewed Asian participants in a workshop on Asian Perspectives on Human Development that was held in

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Ann Arbor, Michigan. These participants included leading experts in psychology and education from China, Taiwan, and Japan. In addition, during the fall of 1991, Shinying Lee visited Taiwan; Kazuo Kato visited Japan; and Harold Stevenson visited Japan and China. During these visits we were able to conduct interviews with individuals highly placed in educational and scientific circles in Taipei (Taiwan), Tokyo and Sendai (Japan), and Beijing (China). In addition to the interviews, we collected written materials related to the education of gifted children in each country. Thus, our descriptions of the programs in each country are current and based on authoritative information.

Research Results

During the past eleven years our research group at the University of Michigan, in collaboration with colleagues in China, Taiwan, and Japan, has conducted a comprehensive series of studies in East Asia, involving large samples of students and their parents. Our primary interest has been the study of mathematics achievement among elementary school students. We have concentrated our attention on first-and fifth-graders; however, in 1990 we extended the age range to include eleventh graders. We have tested and interviewed children and youth, interviewed their mothers, given questionnaires to their fathers, observed in their classrooms, and interviewed their teachers. In each study, we have included comparison groups of American children obtained in the same fashion as the children in East Asia. Our discussion relies primarily on the results we obtained from the tests and the interviews.

Policies and Practices for Gifted Children in China, Taiwan, and Japan

China

Schools in China, like schools throughout East Asia, follow a system of six years of elementary education, three years of junior high school (lower middle school), and three years of high school education (upper middle school). The Chinese government has set the goal of achieving nine years of universal education by the end of the century, but it seems unlikely that this goal can be achieved.

In 1990, 97.9 percent of school-aged children were enrolled in elementary schools (State Statistical Bureau, 1991). Nearly all of these children complete the six years of elementary school, but only two-thirds go on to lower middle school. Admission to lower middle school, and to all subsequent levels of education, depends upon the student's score on entrance examinations. Of those who finish lower middle school, fewer than 40 percent are able to continue their education in high school. Admission to universities is possible for only a very small fraction of high school graduates. Among every 100,000 citizens, there are only 177 college students (State Statistical Bureau, 1989)—a striking contrast with Japan, where the comparable number of college students is 2,006.

The limited opportunities for advanced education produces intense competition among Chinese students, and current government policy is likely to increase this competitiveness. The policy is not to expand higher education, but to extend the reforms of primary and secondary education, improve the quality of education and the condition of schools at these levels, and raise efficiency. The goal for higher education in the future is to produce 25,000 masters degrees and 2,500 doctoral degrees annually from all fields. In view of the fact that approximately 620,000 students enter Chinese universities each year, this degree of restriction in higher education will further exacerbate the competitiveness that already exists among Chinese secondary and college students.

Middle school students follow either an academic or vocational track depending upon their abilities and aptitudes. The government has recently been working to increase enrollment in vocational schools to 50 percent of all upper middle

schools throughout the country, and is striving to improve the number and quality of vocational teachers. At present, only 45.7 percent of the upper middle school students enrolled in vocational schools (State Statistical Bureau, 1991).

Rural children have less opportunity to receive education beyond lower middle school than do urban children. This is evident in the percentages of rural and urban youth who graduate from various levels of schooling: 22 percent versus 48 percent, respectively, in lower middle school; 4 percent versus 16 percent in upper middle school, and .06 percent versus 3.8 percent in college (State Statistical Bureau, 1989). As a result, almost all gifted and talented education programs occur in urban areas.

Education of the Gifted and Talented in China

Special schools focusing on training in dance, music, fine arts, foreign languages, and athletics have existed intermittently in China since the 1950s. Generally, however, little attention was paid to the education of gifted and talented students until the late 1970s. Before then, as part of socialist philosophy, individual differences in intellectual abilities were de-emphasized by educators and government officials. Furthermore, the disorder caused by the Cultural Revolution of the 1960s and 1970s seriously disrupted educational efforts of all kinds.

Education of gifted and talented students in China began to take a more discernible form in 1978 with the creation in Hefei of the first so-called "Youth Class" at the University of Science and Technology of China. By 1985, Youth Classes had been established at twelve other Chinese universities. The availability of classes at all levels for gifted students began to grow from that time on, and in 1988 the first national conference on gifted education was held in Hefei.

As of now, the national government has no policies or institutions that are concerned with the education of gifted and talented students. Nevertheless, numerous programs have been organized both in and out of school by various cities and provinces in China. In-school programs take place alongside the regular curriculum. Out-of-school programs occur either in special schools or during evenings and weekends at the children's regular schools.

Out-of-School Education

The three major purposes of programs for gifted students are summarized in the Chinese appeal: "*Zaochu rencai; kuaichu rencai; chu hao rencai*" (Produce talent early, fast, and of high quality). Students are admitted to out-of-school programs in several ways: upon recommendation by their local schools, through outstanding performance in national competitions, or by passing a battery of entrance tests given by the school to which they seek admission. There is frequent assessment of a student's progress and the possibility of reassignment exists, depending upon a student's performance. Admission to these programs is highly competitive, and students usually must pay tuition.

There are no after-school schools such as the *caiyiban or bushiban* (cram schools) that flourish in Taiwan. Some parents may employ a tutor to assist a child who is having difficulties in school or to provide extra lessons for a child who they think has special talents or abilities. But this occurs very rarely.

Efforts to educate children outside of school hours are predominantly of four major types: Olympic Schools that concentrate on mathematics, special schools for students talented in athletics and the arts, Children's Palaces that offer a wide array of courses, and summer and winter camps that typically concentrate on topics such as science, foreign languages, and computers.

Olympic Schools. The first "Olympic School" opened in 1982. Today there are 18 Olympic Schools serving third- through eleventh-graders throughout China. The largest is in Beijing with 2000 students. The initial inspiration for Olympic

schools came from the International Mathematics Olympiad, where Chinese students have often been first- and second-place winners. There is a common belief in China that mathematics is an area in which Chinese students can become preeminent in the world. For example, of the six Chinese participants in the 1990 Mathematics Olympiad, five won a gold medal and one a silver medal. Nearly all Olympic Schools focus on mathematics, and students are expected to become adept in both mathematical theory and problem-solving. In addition to mathematics, some Olympic Schools emphasize computer science.

Experienced elementary and secondary school teachers, as well as college professors, serve as instructors in Olympic Schools. Teachers in Olympic Schools and national mathematics organizations create the teaching materials.

Special schools. In contrast to mathematics, athletics has been consistently emphasized in modern China. "After-school athletics schools" (*yeyu tiyu xuexiao*) have been in existence since the 1950s. Students admitted to these schools attend after their regular school day for approximately six hours each week. The schools emphasize basic physical skills and athletic techniques, and children are screened once a year to evaluate their progress. In 1956 there were 77 of these schools; by 1990 the number had grown to 3,685.

In addition to after-school athletics schools, special public "athletics elementary and middle schools" have been set up by the government to cultivate promising athletes. These schools offer a regular academic curriculum for six hours a day but also provide training in athletic techniques and theory for three hours a day. Generally speaking, parents prefer these schools to the after-school athletics schools, regarding them as superior in faculty, facilities, and quality of students. The curricula of these schools have been devised by leading experts and scholars with the goal of creating athletes who are competitive internationally and who are well-developed intellectually and morally, as well as physically. Admission is determined by assessment of the student's physical status and abilities and by tests of academic achievement. The success of these schools is evident in the past several Asian Games, where more than 80 percent of the Chinese medalists were graduates of the two types of athletics programs.

After-school schools for students talented in the arts follow a pattern similar to that of the athletics schools. Different types of schools for the arts exist, including those that train students in painting, sculpture, calligraphy, music, and theater.

Children's Palaces. Other programs that take place outside the regular school curriculum are held in China's Youth Palaces. These schools were begun in 1949 with the aim of cultivating student interest in science and art, often in the former residences of affluent families or in other buildings taken over by the government. More than one thousand are now in existence. In 1988, they were placed under the auspices of a newly formed government agency called the "National Association of Youth Palaces." Youth Palaces offer long-term, short-term, night, weekend, and holiday programs in a wide variety of subjects including music, dance, theater, calligraphy, photography, writing, computers, foreign languages, and model building. Each class lasts from six months to a year. Any student can apply for admission to one of the programs, but decisions about admission are based on the results of tests designed to select those students who have acquired the foundation that will allow them to benefit from the training that is offered.

Camps. Programs in summer and winter camps are similar to those offered in the Children's Palaces. Children are selected on the basis of tests and interviews and may attend camp for several weeks during the summer vacation or for one or two weeks during the winter vacation.

Publications. Newspapers and magazines published especially for students help to stimulate interest in math and science. These publications

contain interesting problems and supplementary information for students interested in mathematics, physics, or chemistry. Weekly newspapers such as *Zhongxuesheng Bao* for middle-school students not only publish new material, but also feature innovative or novel solutions submitted by students for earlier problems. Similar publications also exist in Taiwan and Japan.

In-School Education

The purpose of in-school gifted programs, like those of out-of-school programs, is to produce talent "early, fast, and of high quality." To meet these purposes, students are admitted to various programs at an early age. For example, children as young as three can be admitted to elementary schools, eight-year-olds can enter middle school, and ten-year-olds are able to enroll in colleges and universities. To enable students to complete their education more rapidly, the normal twelve years of primary and secondary education can be shortened to as little as eight years. The State Education Commission sponsors a separate type of program for children who are gifted in mathematics and science.

Youth Classes at Universities. Admission to Youth Classes is the most difficult among all of the programs open to gifted students. The rigorous criteria for selection include high recommendations by their school or outstanding performance in a nationwide academic competition, high scores on a battery of standardized tests, and special written and oral examinations. Students must show extraordinary academic promise to be selected for Youth Classes.

Reflecting the high criteria for selection, only 516 students participated in the program at the University of Science and Technology of China between 1978 and 1990. The average age of students entering this program was 14.7 years; the youngest students were 11, and the oldest, 15. Among these students, 85 percent were boys, and the parents of approximately 80 percent of the students were classified as intellectuals.

Once in the four-year program, students follow a curriculum constructed especially for them. A good deal of effort has been spent in preparing these curricula to assure that high school and college materials are properly integrated. For the first three years, these young students enroll in classes that are separate from other university classes. All introductory course work is covered, including the basic courses in the student's major. In their fourth year at the university, Youth Class students are allowed to enter regular courses in the department of their major. As a result of the students' high levels of ability and the care given to their education, their academic achievement tends to be consistently higher than that of their university counterparts. For example, 72 percent of Youth Class students have gone on to graduate school either in China or overseas, compared with 5 percent of all university students.

Staff members at the Special Department for the Gifted Young at Hefei have studied the psychological characteristics of students in the Youth Classes (Zhu, 1991). These students had higher than average scores on measures of perseverance and independence, and possessed "normal physical development and strong physiques." They had high scores on tests of intelligence (an average score of 124 on the Wechsler Adult Intelligence Scale) and of creative thinking, high motivation for achievement, and low levels of test anxiety—characteristics that have been found in many other studies to accompany high academic achievement. Despite the students' high scores on measures of intelligence, they concluded:

> "The early entrants are talented by learning, but not born 'gifted children.' The reason why they are different from other juveniles and enter college earlier at very young ages is that they begin to study on their own diligently when their age mates are unaware of the importance of and not good at studying independently. Therefore, an important aspect of developing the intelligence of the early

entrants after primary or secondary schools is to foster, train, and improve their abilities of studying on their own (Zhu, 1991, 17-18)."

Gifted Programs in the Public Schools. The first experimental class for gifted elementary school students was organized in 1984. Only five- and six-year-olds were generally selected for these classes, and the standard six-year curriculum was taught in four years. In 1985, this experiment was extended to middle schools. A four-year program which recruited gifted elementary students was implemented in lower middle schools. Students entering these classes were on the average under 10 years of age. At the same time, a two-year program was organized in upper middle schools for gifted lower-middle-school students. Students entering this program averaged about 12 years of age. It was possible through enrolment in these gifted programs to reduce the length of the normal twelve-year curriculum by two to four years. The curriculum in these programs seeks to be comprehensive and to develop well-rounded individuals who are capable of individual creativity and of teaching themselves.

In order to be considered for a gifted and talented program, a student is either recommended by his or her own school, or is brought to the attention of the school's authorities by demonstrating excellence in some regional or national competition, such as a math contest or a science fair. Once nominated, the student then must excel on a battery of standardized tests covering both aptitude and achievement, and pass a physical exam. After passing this initial stage, the student must undergo further testing by the school with the gifted program. This set of exams—which includes both written work and interviews—is unique to each school because each school develops its own program for gifted students.

There is little parents can do to help their child gain admission to this or any of the other special programs for gifted and talented students. Admission is limited to students who pass the entrance examinations and who meet whatever other criteria that are necessary for acceptance. Some especially influential parents have been known to override the system and gain entrance for their children, but this is believed to occur very rarely.

Programs for the Gifted in Math and Science. Classes in mathematics, physics, and chemistry were established in 1988 for gifted students at several high schools affiliated with universities. Actual classroom instruction was carried out by university professors, while high school teachers were involved primarily in looking after administrative and disciplinary details.

These special classes have been conducted differently, depending upon the subject being taught. The mathematics class has been a one and one-half year program that students enter after they have been in upper middle school for one year. Physics and chemistry programs have been available during the last two years of upper middle school. In each case, the students have continued with the regular high school curriculum in addition to doing 10 hours a week of additional work associated with the special course.

Problems and Perspectives

Educators and government officials in China point out many obstacles and difficulties that exist in the education of gifted and talented students. Psychological and educational measurement was unpopular for several decades in China. As a result, there are few systematic, standardized ways of identifying and developing appropriate curricula for gifted students. A lack of budgetary support and administrative co-operation among different schools has meant that there is little continuity between gifted programs in different parts of the country or even among different schools in the same region. Little has been done nationally even to identify goals for the education of gifted and talented students.

The programs that do exist have been predominantly at the secondary school level, rather than

representing a thoroughgoing effort to implement gifted programs at all levels of education. Some critics have argued that the programs for gifted students have often been misused, becoming nothing more than programs to help students prepare for college entrance exams. Others have pointed out that, despite efforts to the contrary, programs for gifted students often inundate students with large amounts of information, but fail to teach them how to reason or to think creatively. Current curricula are also criticized as lacking the depth and breadth of coverage that would be of benefit to gifted students.

The concern is often expressed in China, and in other countries as well, that programs for gifted students impede the development of the whole individual. Mathematics and science are usually heavily emphasized and little attention is paid to the humanities. Chinese critics suggest that education for all students, including gifted students, needs to be more attentive to moral education, the fine arts, and physical education. It has been noted, for example, that a high percentage of gifted students are nearsighted, apparently suggesting too much reading and too little physical activity.

In addition, there is a concern that the unusual situation of being selected and labeled as a gifted student may result in uneven personality development, manifesting itself in such things as lack of responsibility, lack of respect for teachers, and lack of self-control. Parents are seen to share part of the blame for this. Some educators believe that parents often push their children too hard and place too much emphasis on success in academics at the cost of giving too little attention to other facets of their child's development. At the same time, it is acknowledged that until the purposes of gifted education are more clearly defined for parents, it may be difficult for them to be involved in constructive ways.

Budgetary constraints have continually hampered efforts at education for the gifted in China. By the end of 1990, every college that had been running a Youth Class program, except the University of Science and Technology of China, had been forced to eliminate the program for financial reasons. Schools do not have the funds available to develop the curricula and facilities needed for gifted programs. Compounding these difficulties is the fact that China faces a shortage of qualified teachers for all its schools and lacks the facilities to train additional teachers in significant numbers. It seems unlikely, therefore, that there will be a significant increase in the near future in the number of teachers qualified to teach gifted students or in the number of classes for gifted students.

As the economy of China improves and funds for education increase, opportunities for gifted and talented students are likely to grow. Whether or not there is an expansion of special programs, gifted students will benefit from future improvements in Chinese schools. The general quality of education in large metropolitan areas already is high and teachers employ pedagogical techniques that appear to be very effective. In our research with urban children in China, Taiwan, Japan, and the United States, for example, Chinese children's scores on a battery of mathematics tests were as high or higher than those of children in the other locations (Stevenson, Lee, Chen, Lummis, Stigler, Liu, & Fang, 1990; Stigler, Lee, & Stevenson, 1990). Further improvements in educational facilities and in the quality of instruction should result in further advances in the remarkable performance of Chinese students.

Taiwan

The history of education in Taiwan is closely linked with that of China and Japan. Taiwan was a Japanese colony for 50 years earlier in this century, during which time its educational system was very similar to that found in Japan. Following the defeat of the Kuomintang government in 1949, Taiwan became the new home for over 1,500,000 mainland Chinese who brought with them the Chinese conception of an educational system and specific guidelines for its operation. Because educators were among this group of immigrants, Tai-

wan's educational system was strongly influenced by the early philosophy and practices that guided the development of public education in China. Although the forms of government differ greatly between Taiwan and China, the two educational systems possess many similarities.

For the past several decades, Taiwan has been undergoing a transition from an agricultural to an industrial economy, and has given high priority to the development and expansion of its educational system. As occurs in other East Asian societies, economic success in Taiwan is closely tied to the acquisition of proper educational credentials. Because of this, getting a good education is considered to be the primary goal for all citizens during childhood and early adolescence.

Education is free and compulsory for all children during the first nine years of the twelve-year program of primary and secondary education. At the end of the nine years, students have several alternatives. Most enter high school; others enroll in vocational or technical schools; some go to work. Currently, 99.9 percent of the children in Taiwan attend elementary school; 99.8 percent of these children attend junior high school; and 84.7 percent of the graduates of junior high schools attend senior high schools or vocational high schools; and 48.7 percent of the senior high and 12.9 percent of the vocational high school graduates continue further to colleges or universities (Bureau of Statistics, Ministry of Education of Taiwan, 1991). In 1990, 576,623 students were studying in universities, colleges, and junior colleges, including nearly 18,000 masters degree students and nearly 4,500 doctoral students. In view of the size of the population of Taiwan (around 21 million), these are impressively large numbers.

Junior high school students have the opportunity to compete by examination for entrance into various senior high schools. Each school is ranked according to its academic reputation, which is based on its success in placing students in top universities. Admission to institutions of higher education is highly competitive and is primarily determined, as it is throughout East Asia, by a student's scores on entrance examinations. When students fail to pass the entrance examination or do not get accepted in the university they would like to attend, most try to take the examination again the following year. Students are allowed to take the examination as many times as they wish.

Generally, students must achieve high scores in all areas, including mathematics, the Chinese language, science, social studies, and English, in order to gain admission to a university. As a result, a significant portion of students at the junior and senior high levels attend private "cram" schools called *bushiban*, as well as their regular schools. *Bushiban* have the single goal of improving student scores on the entrance examinations by supplementing knowledge and enhancing skills in taking tests.

Changes are being considered in the procedure for admission to high school. It is expected that in 1992, junior high school graduates in Taipei will enter the senior high school through a new type of application procedure that is being developed, rather than through entrance examinations. The goal of the government is to abandon the entrance examinations for senior high school by 1995.

Gifted and Talented Education in Taiwan

Active interest in providing special opportunities for gifted and talented students occurred relatively recently in Taiwan. Government and educational officials first became interested in the education of academically gifted students and of students talented in fine arts, drama, and music in the early 1960s. Shortly afterward, following the 1962 meeting of the Fourth National Educational Conference, steps were taken to institute the first programs for gifted children. During the following year, the "Experimental Education for Gifted Children" program was begun in fourth-grade classrooms of two elementary schools in Taipei. The intention in establishing this program was to begin the process

of developing supplementary learning materials for academically gifted students.

The government's interest in education for gifted and talented students grew out of recognition of the fact that a province with few natural resources must develop its human resources. Steps have been taken during the past several decades not only to improve education generally, but also to give greater attention to the education of all individuals with special needs (Wu, 1988, 1989). In 1968, compulsory education was extended from six to nine years, and accompanying legislation specified that special education was to be provided for gifted children. In 1971, an experimental curriculum for gifted children was created in one elementary school at the fifth-grade level, with special enhanced curricula in mathematics, natural science, and the Chinese language. The project lasted for three years. Shortly afterward, the Ministry of Education began a six-year program throughout Taiwan for gifted elementary school students. The program was extended to the junior high level in 1979 and to the senior high level in 1982 (Special Education Association of the Republic of China, 1988). All of these programs are operated through the public school system; the government plays an almost exclusive role in setting up and funding special education programs.

Programs for gifted and talented students are of three types: general programs such as those just described, programs in mathematics and science, and programs for students talented in the arts, music, and dance.

Students gifted in mathematics and science. As has typically been the case throughout the world, special attention was given first to highschool students who showed special promise in mathematics and science. Special programs for these students were begun in 1983, in response to the growing concern by the government with developing scientific and technological skills in the populace. Students gifted in these fields have the opportunity to be tutored by college professors and in some cases are allowed to skip their final year of high school and proceed directly to college. If they are unusually talented, they are allowed to enter college without taking the entrance examinations. A new science high school is being established and will accept students with superior performance in mathematics and science, beginning in the fall of 1992.

Students talented in music and the arts. Special efforts to teach musically gifted students began in the early 1960s in a private elementary school in Taipei. It was not until ten years later that the first public elementary school in Taipei created a similar class. A recent survey revealed that music programs for talented students have been established in 28 schools which enroll over 3,300 students; 29 schools have fine arts programs involving nearly 2,500 students; and 18 schools have dance programs involving over 1,400 students.

Provisions have also been made for talented students to bypass high school and college entrance examinations and enroll directly in college departments of music and fine arts. In the fine arts they are able to study many different subjects, including sketching, watercolor painting, graphic arts, carving, and sculpture. All areas of music can be studied, including choral and solo vocal music and solo and ensemble instrumental as well as music; and folk, ballet, and classical Chinese dance.

Identifying the Gifted and Talented

Clearly defined criteria must be met before students can be enrolled in gifted and talented programs. As might be expected, most students are first identified and recommended by their teachers. Next, according to national education law, students must (a) receive a score higher than two standard deviations above the mean on the IQ test given at the beginning of every school year, and (b) have a grade point average that is in the top 2% of their class or receive a score higher than one standard deviation above the mean on an achievement test covering all subjects in the curriculum.

In order to be considered gifted in the specific areas of mathematics or science, students must receive a score higher than one standard deviation above the mean on an achievement test in mathematics and science or on a test of intelligence or creativity. In addition, they must have a grade point average in the top 1% of their class in mathematics and science or have performed well in a national or international competition.

The criteria are equally stringent for students talented in other areas. They must receive an above-average score on an IQ test and a score at least two standard deviations above the mean on an aptitude test measuring their special talent. They also must have distinguished themselves in some national or international contest.

Once students have tentatively been identified as gifted or talented, a committee made up of teachers and administrators from the students' schools submits a report to the education department of the local city government. After further screening by the department, qualified students are placed in appropriate special programs or schools.

Current Approaches

Currently, there are two main approaches to the education of gifted and talented students in Taiwan. In the "self-contained" approach, gifted and talented students are grouped together in one class and the standardized national curriculum is broadened in ways that will meet the needs of these students. The other approach is to keep students in regular classes but give them access to a special "resource classroom." Students in these classrooms receive tutoring to supplement the standard curriculum and have access to special materials (Lee, 1987).

The government has expanded the number of programs for gifted students greatly during the past decade. In 1991, 126 elementary schools, 102 junior high schools, and 35 senior high schools were conducting programs for gifted students (Bureau of Statistics, 1991). More than 23,000 students participated in these programs—a four-fold expansion since 1982, when only 5,800 students were enrolled.

For all programs, students must remain in the grade level appropriate for their age. According to the National Education Law, students who are deemed to be generally gifted and distinguish themselves in all areas of study are allowed to skip only one year in elementary school, junior or senior high school.

Students who are identified as gifted in either mathematics and science, but not necessarily in other areas, have the opportunity to take part in special weekend programs and summer camps conducted by university professors. They also are allowed to take the entrance examination for the next level of schooling at the end of their second year of junior or senior high school. Alternatively, they may qualify to bypass university entrance exams altogether and move directly into science or mathematics departments in universities. Entrance is restricted, however, to pure science departments, such as chemistry or physics, and mathematics; gifted students are not given privileged entrance into applied programs such as engineering.

Training Teachers

As the concern with special education has grown in Taiwan, colleges and universities have developed special training programs for teachers. Twenty hours of course work in gifted education are required in order to become a qualified teacher of gifted and talented students. Alternatively, teachers already in the work force can take short-term training programs designed to prepare them for teaching these students.

Problems and Perspectives

As Taiwan has continued to develop economically, the government has placed more and more emphasis on improving the quality of education offered to its citizens. In fact, improvement of education is part of a new six-year national develop-

ment project that is currently being launched. Education for the gifted is likely to benefit greatly from this project, for the government considers the performance of gifted students to be an important indicator of the general quality of education being provided throughout the province. Moreover, education authorities also hope to use teaching methods developed for the gifted with ordinary students, especially methods for promoting problem-solving and creative thinking.

The current system of education for the gifted and talented is not without its critics. Some object to what they consider to be a continuing overemphasis on the very rigid examination system, which they believe undermines gifted and talented education. Talented students, for example, are often torn between developing their special talent and preparing for the entrance examinations that are so important for their future success. Consequently, many parents and educators have become advocates for comprehensive programs of gifted education that continue from kindergarten through college.

Other critics believe the programs for gifted students place too much emphasis on preparing students for the college entrance examinations, rather than on attempting to broaden their knowledge and abilities. Another objection is that students gifted in mathematics and science should not be restricted to careers that emphasize only pure science. Some parents have actually kept their children out of such gifted programs so that they would have the option later of pursuing careers in other fields, such as engineering.

There are concerns, too, about the manner in which education for gifted students is organized. Debate continues about the relative merits of the "self-contained" and "resource classroom" approaches. Students in self-contained classrooms performed better on tests of academic achievement and creativity than their counterparts assigned to resource classrooms. However, some critics have expressed concern about whether appropriate social and emotional development of students takes place in the self-contained classes, where social interactions are restricted to those involving other gifted students. There are also those who have complained that the curriculum from the resource classroom and the regular classroom are not adequately integrated, and that trying to keep up with both overburdens students.

Other continuing challenges facing gifted and talented education programs in Taiwan include a lack of qualified teachers, the need for better selection devices, the paucity of competitions and scholarships for gifted and talented students, and the need to develop library and museum resources and other extracurricular activities to supplement classroom instruction.

Efforts are being made to expand special education training programs for teachers, including those who teach in kindergartens and in elementary schools, and to increase teacher access to conferences and workshops on gifted and talented education. Education departments of colleges are being encouraged to develop full-fledged graduate programs to which practicing teachers can return for additional training, and explorations are being made for increasing the opportunities for teachers to go abroad to study practices in other countries that have developed programs for gifted and talented students. In order to attract more teachers to the field, officials are considering supplementing the salaries of teachers of gifted and talented students.

Japan

Unlike China and Taiwan, Japan has no formal government programs aimed at cultivating the abilities of gifted and talented children. To understand why this is the case, it is necessary to consider certain aspects of Japanese culture and how these have influenced the development of the Japanese educational system. We begin with a discussion of changes that have occurred in Japanese educational philosophy since the opening of Japan to the West in the middle of the last century.

Pre- vs. Post-war Education

After the Meiji Restoration in 1868, when Japan reopened itself to the rest of the world, the government began to revise and modernize its education system. Its model was the elitist European system in which enrolment was restricted to individuals privileged by their economic or social status in society. By 1919, when Japan was firmly established as an international power, the government realized it was necessary to make education open to all citizens. The Government Responsibility for the Basic Support of Compulsory Education Act was passed, making the national government accountable for the major educational expenses for the six years of elementary school. Only the social and economic elite were expected to pursue education beyond these six years.

Because the so-called "higher school" education involved relatively small numbers of students, curriculum guidelines were few and loose, and teachers had a great deal of freedom to structure the pace and the content of study. Indeed, one official we spoke to suggested that gifted students probably received more attention then than they do now, because teachers were in a position to cater to the interests and abilities of individual students.

World War II and its aftermath brought profound changes in the Japanese education system. With the advent of American influence during the occupation and the adoption of the postwar Constitution, the Japanese populace pursued the equality they understood to be a product of democracy and swept away old types of social privilege. Not surprisingly, education underwent profound changes. The elitist European system was abandoned in favor of what education leaders refer to as a "formal egalitarian" system of education.

The guiding principle of today's system is that students throughout Japan should have equal access to comparable school facilities. To ensure equal access, the national government covers half the cost of teacher salaries, teaching materials, and construction of new buildings, and one-third the cost of maintaining existing buildings. The remaining expenses are the responsibility of local school districts. Education officials believe that this has served to create comparable teaching and learning conditions throughout Japan.

The administration of education in Japan, as it is in China and Taiwan, is highly centralized, and the Ministry of Education defines the content of textbooks and curriculum guidelines. The rationale for this degree of centralization is that only in this way will all students be properly equipped with the basic skills necessary for competition in contemporary society. Although teachers are given wide latitude in teaching the curriculum, there is a great deal of uniformity in the subject matter and skills that are taught throughout the nation. As one former education official told us,

> ". . . in the second term of the second year of primary school, teachers begin to teach multiplication skills everywhere in Japan. They do it thoroughly. When I was a child, we memorized our multiplication tables from 9 x 9 down to 2 x 2. It's impossible for a student to finish second grade in Japan and not know the multiplication table."

At the elementary school level, the concern is not with identifying individual differences and singling out gifted students for special attention, but with providing all students with certain necessary skills. The same official told us he was proud of Japan's "very uniform and rigid primary school system," and went on to say:

> "Since a democratic society is a competitive society, we need to assure that they [the students] will have the basic skills they need to compete. As long as they have these basic skills, it is up to them where to go or how much effort they want to give in order to succeed in competition."

Special treatment, such as allowing a student to skip a grade, is extremely rare in Japan. Special classes for gifted students do not exist. Such classes

would be regarded by both educators and parents as displaying unfair favoritism, thus violating the egalitarian philosophy on which the education system is built. Teachers often indicate that they do not especially appreciate having gifted children in their classrooms. The children they find more impressive are those who work hard. Besides, they say, gifted children only have the potential (*senzai*), and should learn the importance of hard work: "If you don't polish the stone it will have no luster."

At the high school level, some efforts have been made to recognize and accommodate divergent student interests and abilities, but these have also met with opposition because they smack of "elite education." We frequently heard comments suggesting that if a certain group of students is treated differently, other groups will complain about not having equal opportunity.

In the last two decades, the Ministry of Education has tried to introduce more flexibility into the high school curriculum. The number of required courses has been reduced to allow students to pursue their own interests, and teachers have been granted more flexibility to meet the individual educational needs of students. The Ministry of Education encouraged teachers to arrange classes according to student achievement so that all students would still be assured of learning the basic skills expected of high school students. To accomplish this, local schools were permitted to develop tracking systems, known as *seijukudo gakkyu hensei* , in which a student would be placed in a slow, average, or fast class depending upon that student's previous performance in a subject. The system does not require long-term assignment to a particular track; if a slower student's work improves, he or she moves up to a higher level. The basic content of the curriculum is the same in all tracks; only the speed with which it is taught varies. To help slower students master the basic skills, the Ministry of Education proposed that these students should be taught by master teachers.

This system was fairly widely implemented after the "second baby boom" in the mid-seventies, when schools were faced with a large number of students with wide variability in ability and preparation. By the early 1980s, about 40 percent of high schools practiced some degree of tracking; however, it seems never to have gained popular acceptance outside the urban areas of Tokyo and Osaka. The major objection was that it appeared to be a return to an elite form of education.

After-School Activities

Special opportunities do exist in the public schools for students to enrich their education through after-school clubs and classes. These extracurricular activities are open to all students and a high percentage choose to participate. During elementary school, students remain for an hour or more after their regular classes have ended; during high school they may remain for several hours. The range of activities depends upon the size of the school, but includes such diverse topics as orchestra, calligraphy, computer programming, sports, literature, geology, biology, art, chemistry, and journal writing and editing. While these activities are not offered especially for gifted and talented students, they do offer students a much broader scope of activities than those contained in the regular curriculum. Thus, although the length of the regular school day in Japan is comparable to that found in the West, these after-school activities keep students at school for much longer periods of time.

Kosei Kyoiku

Several of the experts and officials we talked to indicated that the educators and the Ministry of Education are still concerned that Japanese high school curricula are too rigid. Recently, the Ministry has proposed what they call *kosei kyoiku* , which may be roughly translated as "individualized education." It is an attempt to encourage high schools to make their curricula more flexible so that the schools can do a better job of meeting the individual interests, abilities, and needs of the students.

What is meant by *kosei kyoiku* remains vague, and educators are not clear about what individual-

ized instruction would encompass. The term *kosei* in Japanese carries more of a sense of individual differences in personality, rather than of individual differences in academic ability. Still, *kosei kyoiku* is quite different from conventional programs for gifted and talented students that seek out students with high academic ability. *Eisai kyoiku* is a direct translation of gifted education, but in our discussions a question was often raised about its goals. Would *eisai kyoiku* be defined by *noryoku*, a term describing capability, and usually implying mental capability? Would it include children characterized by *saino* , translated directly as talent? The question of whether *eisai kyoiku* should be directed primarily at promoting individuality, intellectual ability, or talent is not likely to receive a quick answer.

Elite Education vs. Gifted and Talented Education

In our conversations with Japanese education officials we sometimes found that they substituted the term "elite education" in their replies to our questions about gifted education. Discussion of special programs for gifted children seems to bring up images of the pre-World War II system of education based on the European models and restricted to students of socially or economically privileged families. Schools or programs that are organized to prepare the next generation of the elite to lead Japan are rejected in the egalitarian Japan of today.

Although entrance into the elite schools was not based upon ability, Japanese citizens apparently assume that the goal of special education of the gifted and talented is the same as that of the old elite system of education: to single out a group of students for special privileges later in their lives. The current social atmosphere in Japan is intolerant of any attempts that even appear to subvert the post-World War II egalitarian system that now prevails in Japanese public schools. Each child, says the Japanese parent, should be given the same chance to gain high positions in society. Although parents and teachers recognize variation in ability among students, they generally believe that any student who works hard has the potential to be a high achiever. They justify the stratification of high schools and colleges by pointing out that all children were given equal opportunities during the first years of schooling. Some children responded appropriately to these opportunities by studying hard; others did not. It is not unfair, they argue, that those who have already demonstrated their diligence should have greater opportunities to benefit from higher levels of education than those who failed to show such devotion to their studies.

High School

Compulsory education in Japan extends through the ninth grade. High school attendance is not mandatory, although over 95 percent of youths of high school age graduate from high school. In stark contrast to the egalitarian system that is strictly adhered to in elementary and junior high schools, a hierarchical order exists among high schools. High schools, especially in urban areas, are ranked into four levels according to their quality. The highest ranked schools are ones that have the greatest success in placing students in good universities; the lowest are those whose students specialize in vocational or technical education. "Can we say," an educator asked earnestly in one of our discussions, "that the number one school provides *eisai kyoiku* ?"

Students in Japan are admitted to a high school of a given level on the basis of results of entrance examinations. Competition for entrance into top high schools is keen because one's high school education has great importance for passing the examination to a good university. All students take the same high school entrance examination and in principle have an equal opportunity to enter a top high school. It is primarily through entrance examinations, first for high school and later for university, that individual differences in ability among students become acknowledged.

An alternative route to admission does exist in the case of college entrance. A certain percentage

of students, sometimes up to one-fifth, are able to bypass the entrance examination system via the *suisen* (recommendation) system. It has been the practice, primarily in private universities, to make a small number of places in each of their departments open to students from select high schools. Some universities might require an interview or a test of some type, but generally the students are allowed to avoid taking the stressful college entrance examinations.

Public universities have recently adopted and greatly expanded the *suisen* system. Rather than establishing relationships with specific high schools as they had in the past, departments in public universities set aside a few places to be filled by students with unusual qualifications. These include outstanding academic achievement or some other type of exceptional life experience, such as living overseas. The university interviews students who have been recommended by their schools and decides which ones to accept. Admission into these programs is competitive, but reliance on recommendations rather than scores on a college entrance examination has the potential of significantly modifying the way in which Japanese students gain entrance into universities.

Mention should also be made of private high schools. In addition to public high schools, private high schools are also popular, especially those that have good records in placing students in top universities. Private schools are able to pay greater attention to individual differences and to develop programs that will promote special talents and skills. Because they are more successful than public schools in instituting such programs, some of the educators with whom we talked suggested that private schools really insight be considered to provide *eisai kyoiku* .

Juku or Supplementary Schooling. In order to compete more effectively on high school and college entrance examinations, students turn to *juku* (cram schools analogous to Taiwan's *bushiban*). *Juku* are entirely outside the official education system and are not supervised by the Ministry of Education.

In addition to self-improvement *juku* that teach such things as music, calligraphy, abacus, and martial arts, there are two kinds of academic *juku*. *Hoshu juku* provide remedial instruction for students struggling with their schoolwork. *Shingaku juku* are the ones that specifically aim at preparing students for entrance examinations. The education officials we talked to generally expressed displeasure with the existence of *juku* , saying they felt that they too often emphasized material beyond what students at a given level should be expected to learn. Further, one person noted that this sort of juku created problems for egalitarian education:

> "*Juku* have begun to play the role of distinguishing among students by administering mock exams, the results of which could be compared to a large population of other students, thereby giving students an indication of their standing relative to others. Therefore, students began to discover divergences in ability among themselves by attending these *juku* because the regular schools refused to make such distinctions.

The main criticism of *juku* was from education officials who stressed that the official curriculum alone did a good job of equipping students with the appropriate skills. These officials expressed dismay that parents and students believed it was necessary to supplement an educationally sound curriculum with work in *juku* . Despite this view, attendance at *juku* is widespread, especially in large metropolitan areas. It is estimated that there are more than 35,000 *juku* in Japan, comprising an industry involving about six billion dollars a year (Adachi, 1988).

Possible Reforms. In addition to current discussion about how high schools might implement more individualized education, an interest in introducing reforms at the college level has also arisen. The Central Council for Education, an advisory body

to the Minister of Education, has discussed modifications of entrance requirements to universities that might foster the development of students with special talents and interests.

Currently, students must make high scores on all aspects of the college entrance tests. This system selects students who have talent overall, but ignores those with special talents. The Council may propose that students who are gifted and talented in particular areas be admitted to universities even if they do not have high scores on the total entrance examination. A related recommendation would be to allow highly talented high school students to enroll in university courses in mathematics, physics, and a limited number of other fields. A third recommendation being discussed is to lower the age for university entrance—but only in the field of mathematics—below the currently legal age of 18. No one has gone so far as to propose comprehensive programs for gifted and talented students such as those found at the secondary levels in China and Taiwan, and the idea of providing special opportunities to gifted students below the high school level is still considered to be inappropriate.

Problems and Perspectives

Predicting whether Japanese officials will ever introduce a broad system of special programs for gifted students is risky, but on the basis of contemporary Japanese philosophy and past educational practices it seems doubtful that this will occur in the near future. Special programs for gifted young children are unlikely to flourish in a culture where elementary school teachers would never tell parents directly that their child is gifted or advanced over other students and where there is assiduous avoidance of direct forms of teaching in nursery schools and kindergarten for fear that it would produce inequities in first grade. Teachers may provide subtle forms of encouragement to bright students by encouraging them to apply to good high schools, and indirect forms of teaching may be provided by parents and teachers before children enter school, but there is general avoidance of discussion of innate differences in ability. Even in high school, teachers do not praise especially sophisticated or straightforward ways of solving problems if the solutions are not dependent upon what has already been taught. Regardless of whether students have learned advanced mathematics on their own or whether they have already read the material that is assigned, they are given no opportunity to skip the classes which cover these topics. The only accommodation occurs in those high schools where such students are placed in the fast track. These students complete the regular assignments during the first half of the year; the second half is devoted to study of enrichment materials.

Some tension exists within Japanese society between egalitarian education and *eisai kyoiku* . One persistent theme is that all children should be given equal opportunities for a good education, but there is also the counter theme that, like China, Japan should be producing students "earlier, faster, and better." The home-study Kumon lessons and the Suzuki approach to early musical training have become very popular as means of enhancing public education for young children. Even the Chairman of the Sony Corporation has entered the argument by suggesting in a widely read book that kindergarten is too late for initiating formal education (Ibuka, 1977). Whatever form education of the gifted and talented may ultimately take in Japan, one thing appears to be sure: gifted education will not be part of the government-sponsored educational system, but will be something that highly motivated parents will provide for their children through private lessons.

Japan is a society in which children are exhorted to study hard and are told that if they apply themselves they will be able to achieve. The great emphasis on effort and the purposeful de-emphasis of innate abilities has paid off in terms of the remarkably high average levels of academic achievement and indirectly in the country's vast economic success. But the Japanese are beginning

to worry about why they are not producing larger numbers of basic scientific discoveries and more Nobel prize winners. Educators are especially concerned about how they can stimulate greater creativity and better problem solving in their students. Any discussion of education in Japan inevitably turns to these topics. How these worries and concerns may influence educational practices for gifted and talented students in Japan will be interesting to observe in the coming decades.

Results of Comparative Research

We turn next to the research projects we have conducted with students from China, Taiwan, and Japan and their counterparts in the United States. The analyses we report are for two types of highly able students. We focus our attention in the first set of analyses on the characteristics of students who demonstrated outstanding cognitive ability on a battery of tests of the types commonly included in intelligence tests. In the second set of analyses we discuss correlates of outstanding achievement in mathematics, a topic about which we have collected a great deal of information. We use data from the following studies:

1. Our first study, conducted in 1980, included 960 children, half from Sendai, Japan and half from Taipei, Taiwan, selected as representative samples of first-and fifth-graders from those cities. We also included 480 children from Minneapolis. The children were interviewed, tested for reading and mathematics achievement, and given a battery of ten cognitive tasks. The cognitive tasks included tests of coding, spatial relations, perceptual speed, auditory memory, memory for words, memory for numbers, verbal memory, vocabulary, general information, and verbal-spatial representation (Stevenson et al., 1985). Mothers also were interviewed. After completing this study we conducted a parallel study of kindergarten children of which we make brief mention.

2. In 1986-87, we conducted a much more thorough exploration of achievement in mathematics. In this study we visited 10 schools in Taipei and Sendai and 11 schools in Beijing. From each school we selected representative samples of 12 first graders and 12 fifth-graders. We also included 12 first- and 12 fifth-graders from each of 20 schools in the metropolitan area of Chicago. The children were given a battery of mathematics tests, and they and their teachers and mothers were interviewed. We replicated this study in Beijing in 1990.

3. In 1986-87, we also conducted a study of children's adaptation to school in Beijing and in Chicago. We gave tests in reading and mathematics achievement to over 2,400 first-, third-, and fifth-grade students in Beijing and nearly 3,000 in Chicago.

4. We replicated part of Study 1 in 1990 with 240 fifth graders from each of the three cities, Taipei, Sendai, and Minneapolis. We visited the same schools that we had visited in 1980 and tested children with the same tests and interviewed mothers about the same topics included in the earlier study. We also interviewed students about many of the topics included in Study 2.

5. A large study of eleventh-graders was conducted in Sendai, Taipei, and Minneapolis in 1990 and 1991. One part of the study included representative samples of approximately 1,200 Japanese, 1,500 Chinese, and 1,000 American students. We gave them tests of mathematics and general information, and asked them to answer items in a long questionnaire dealing with their attitudes, beliefs, and current life situations. In a follow-up study conducted at the same time, we located as many of the first- graders from our 1980 study (now eleventh-graders) as we could find. We place greater reliance in this report on the cross-sectional data because not all of the Japanese data from the follow-up study have been analyzed.

Students of High and Average Cognitive Ability

Giftedness is often defined in terms of intelligence. Data from the battery of cognitive tasks

given at first and fifth grades in Study 1 make it possible to form groups on the basis of their scores on tests of cognitive ability. We selected two groups; one we will term "highly able" and the other, "average." At each grade we selected approximately 24 students whose scores were in the top decile of scores on the battery of tasks for a "highly able" group and a corresponding group of approximately 24 students whose scores clustered most closely to the average for an "average" group. There was no consistent tendency for boys or girls to be more frequently represented among the highly able students. At first grade, a lower percentage of boys than of girls received the high scores in Minneapolis (39 percent) and Taipei (37 percent), but slightly more boys than girls were in the highly able group in Sendai (56 percent). The corresponding percentages at fifth grade were 67 percent, 46 percent, and 52 percent.

Academic achievement. One of the first questions we asked about the two groups of children is how well they were achieving in school. Level of cognitive ability has frequently been found to be related to academic achievement. The question here is whether the level of achievement differed between the highly able and the average students to the same degree in the diverse cultures in which our research was conducted.

Students who received high scores on the cognitive tests out-performed the average students on both the mathematics and reading tests. First-graders in the highly able groups could read many more words and phrases and were better able to understand what they read than were the average children. The highly able students also surpassed the average students in their ability to solve computation and word problems (see figures 1 and 2). Differences in scores on the achievement tests between the highly able and average groups of children were equivalent among the three cultures. However, the differences between the highly able and average groups 'were' less marked at fifth than at first grade, probably reflecting an increasingly strong influence of variables other than children's cognitive ability on academic achievement.

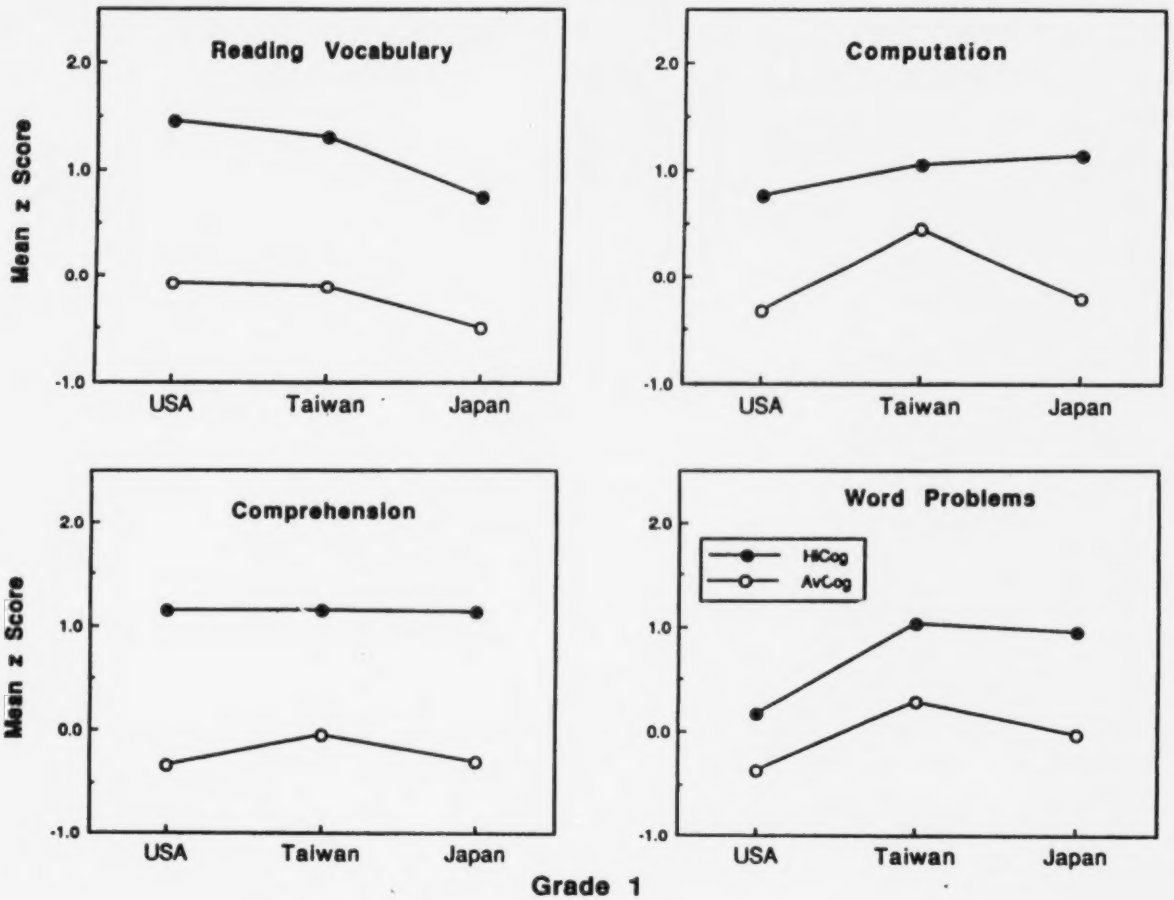
Scores at eleventh grade. We can also determine the predictive value of the early cognitive tasks by asking whether the scores obtained in first grade were effective in distinguishing between achievement scores at eleventh grade. Scores were available for mathematics, reading comprehension, and general information. The latter test tapped information that was not necessarily taught in school, such as why blankets keep us warm and why it has been possible to make smaller computers in recent years.

Bright first-graders were not only high achievers at first grade, but also ten years later when they were in high school (see table 1). They knew more than the average students about reading and mathematics, and also had a broader fund of general information about the everyday world.

Mothers' perceptions. Mothers in all three cultures tended to rate their children as being average or above in their intelligence and in their achievement in mathematics and reading. This is evident in the data summarized in figure 3. The average students received ratings that were above average—but significantly lower than those obtained by the highly able students. The differences between the ratings for the highly able and average groups were largest in Minneapolis and the smallest in Sendai.

Mothers in all three locations gave other indications of their awareness of their children's level of cognitive ability. Mothers of highly able students consistently gave their children higher ratings than did the mothers of average children on intelligence, memory, ability to learn new things, and at fifth-grade, to express themselves verbally and pay attention. In addition, mothers of highly able fifth-graders believed that their children would complete more years of school than did mothers of children in the average group and that their children had higher potential to do well in school. Ratings made by mothers of the highly able and average students differed from each other to the same degree in all

Figure 1.— Mean standard (z) scores on reading and mathematics achievement tests of the groups of first-grade students of high and average cognitive ability.



three locations. Only on two characteristics related to cognitive ability, creativity and curiosity, did the highly able and average groups receive similar ratings. We have no explanation for this departure from the general pattern other than to suggest that the mothers may not have had clear conceptions of these attributes.

The picture was different for personality and social characteristics. Ratings of the children's level of anxiety, approval-seeking, obedience, restlessness, and shyness were generally not related to their level of cognitive ability. Nor, surprisingly, did the mothers, ratings of children's curiosity and creativity differ according to cognitive level. Significant differences appeared for only two characteristics, and then at only fifth grade. Highly able students in all three cities were rated as being more persistent, and in Taipei and Sendai they were given higher ratings for self-confidence.

Use of out-of-school time. One might expect that highly able and average students would spend their out-of-school time in different ways. According to their mothers, this was not the case for

Figure 2.— Mean standard (z) scores on reading and mathematics achievement tests of the groups of fifth-grade students of high and average cognitive ability.

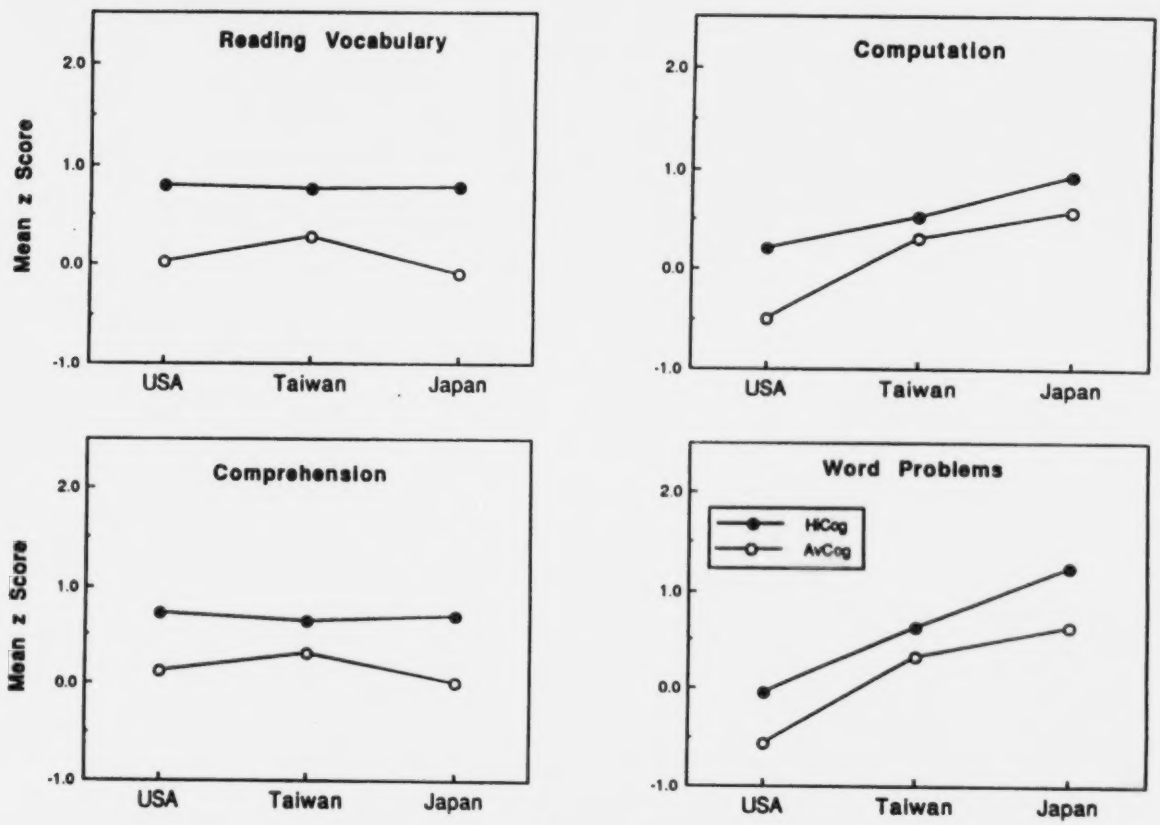


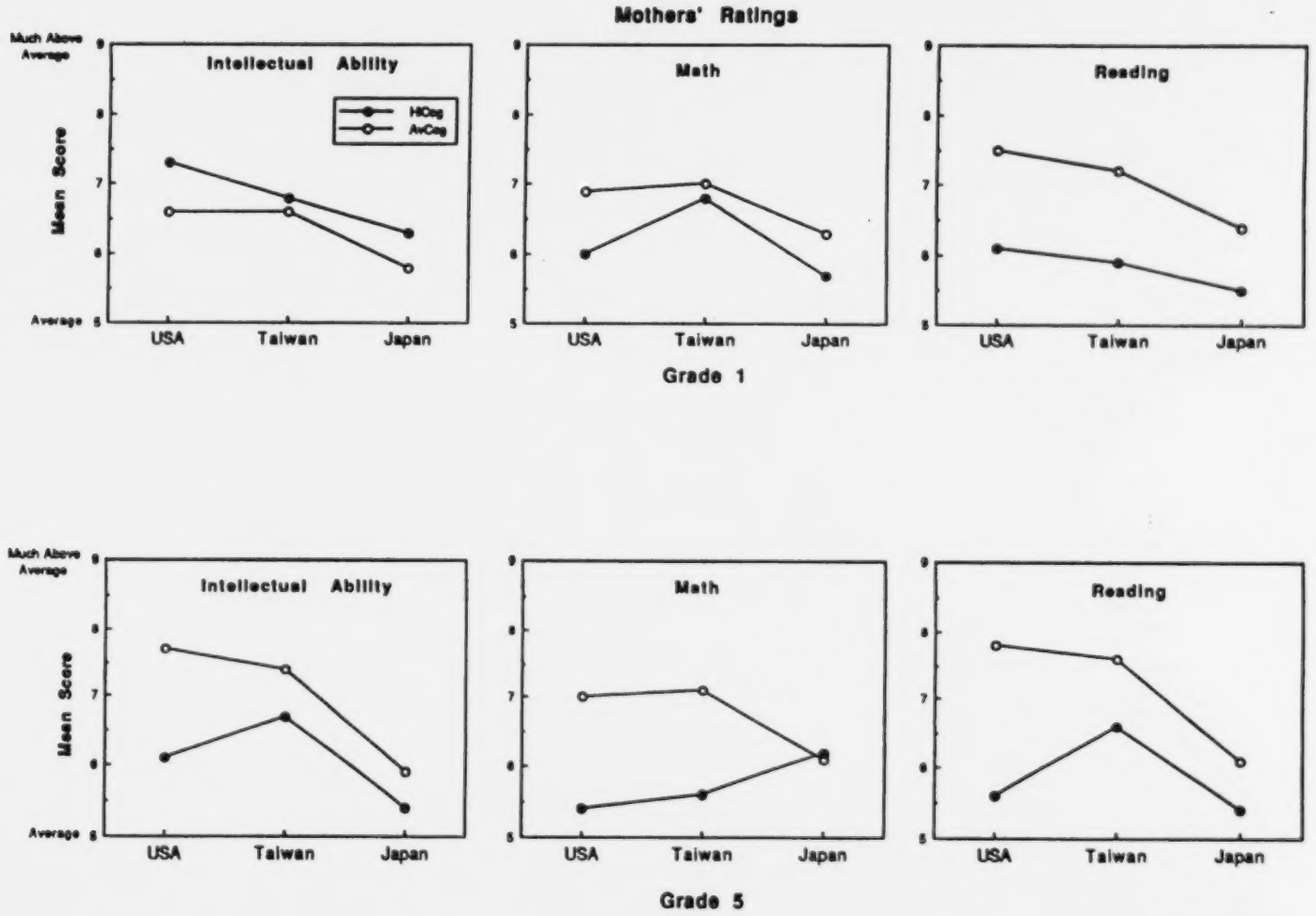
Table 1.—Weighted mean z scores of eleventh grade students who at first grade were in the average and highly able groups in terms of cognitive ability.

	United States		Taiwan		Japan	
	Average	High	Average	High	Average	High
Mathematics	-.54	.55	.34	1.29	.20	.71
Reading comprehension	.15	.59	.15	.70	-.30	.72
General information	.11	.91	-.01	.75	-.10	.53

watching television, doing homework, and at first grade, playing. At fifth grade, however, highly able students spent less time playing than their average peers. The highly able students in Minneapolis spent 14 hours a week playing; the average students, 21 hours. Even so, the highly able students in Minneapolis spent more time playing than did their peers in Sendai and Taipei, who were estimated to play only 13.0 and 6.3 hours a week, respectively.

One way in which highly able and average students differed consistently was in the amount of time they spent each week in reading for pleasure. Highly able students in Minneapolis, Taipei, and Sendai spent more time reading for pleasure than

Figure 3.— Mothers' ratings of the intellectual ability and reading and mathematics ability of the groups of students who received high and average scores on the cognitive tasks.



the average students. At first grade the estimates differed, respectively, by a quarter hour, half hour, and over three hours a week. By fifth grade, the corresponding differences were one hour, two and a half hours, and nearly three hours. These data offer interesting support for the view that highly able students are distinguished by their ability to learn a great deal by themselves.

Students with High and Average Achievement in Mathematics

We turn next to comparisons of students who displayed high levels of achievement in mathematics with those who performed at an average level. Performance in mathematics was selected as a second example of giftedness because of the widespread interest in the topic and because we have a great deal of information about students who do well in mathematics.

We developed our own tests of mathematics achievement in order to be sure that the tests were appropriate for the students in each culture. The tests were based on our detailed analyses of the content of the textbooks or workbooks used in the schools of each city. Information from these analyses made it possible to construct items of the types and levels of difficulty that children encounter every day at school. As a further check on the cross-cultural applicability of our tests and interviews, we routinely submitted all items to psychologists and educators in each culture for review.

Items for the kindergarten test ranged from identifying numerals, counting, and ordering, through adding and subtracting in simple computation and word problems. The test for elementary school students included more difficult computation and word problems. The test for the eleventh-graders was comprehensive and contained items ranging from simple inequalities to complex geometry and algebra.

We formed high-achieving groups in each city by selecting the students whose scores were in the top decile on the mathematics test. We also formed contrast groups of average students whose scores clustered around the average for the total group in each city.

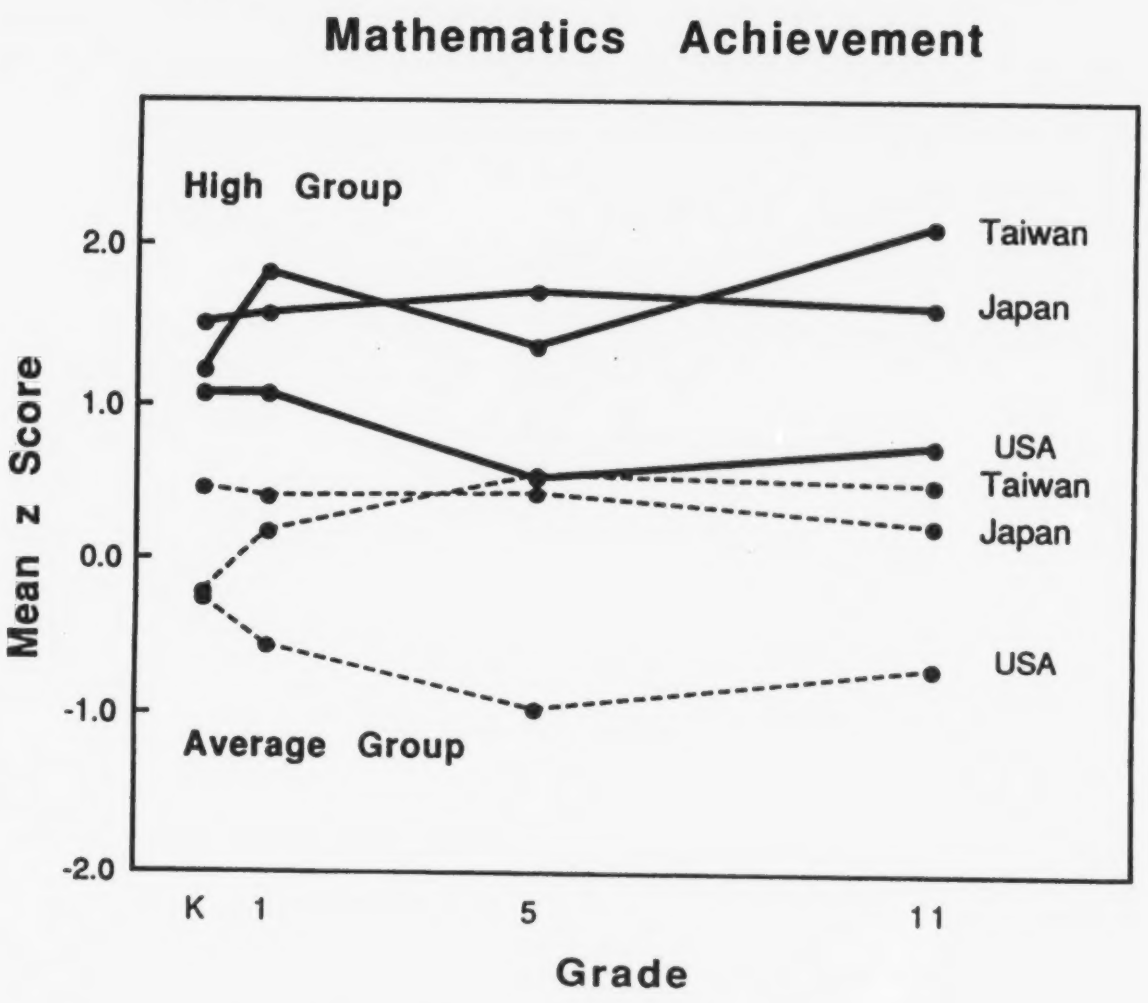
Mathematics Achievement. Scores on the mathematics tests of both the high achievers and the average students from Taipei and Sendai exceeded those of their Minneapolis peers at all grades after kindergarten. The degree of difference between the cities was so great that students considered to be high achievers in mathematics in Minneapolis were within the range of average students in Taipei and Sendai. This is illustrated graphically in figure 4, where the data are plotted in terms of weighted z scores computed at each grade level for all samples. The average scores of the high achieving American fifth- and eleventh-graders departed little, if at all, from those of the average Chinese and Japanese students.

The same effect appeared when comparisons were made between high achievers and average groups in Beijing and Chicago (see figure 5). In these comparisons, the high achievers in Chicago at first, third, and fifth grade received scores at or below those of the average groups in Beijing. Clearly, we are not talking about the same degree of proficiency in mathematics when we compare children in the top decile of mathematics scores in China, Taiwan, and Japan with the top decile of children in the United States.

Sex Differences. There was a predominance of boys among the high achievers in mathematics. In both Taipei and Sendai, there were more boys than girls at all grade levels. This was dramatically evident in Sendai, where nearly all of the high achieving students at the eleventh grade were boys. In Minneapolis, the groups included more girls than boys through fifth grade, but boys outnumbered girls at eleventh grade (see figure 6). In Beijing, there was a greater percentage of boys in the high-achieving groups at all grades: 64 percent (first grade), 58 percent (third grade), and 63 percent (fifth grade).

Educational level of parents. Parents of high-achieving and average students differed much

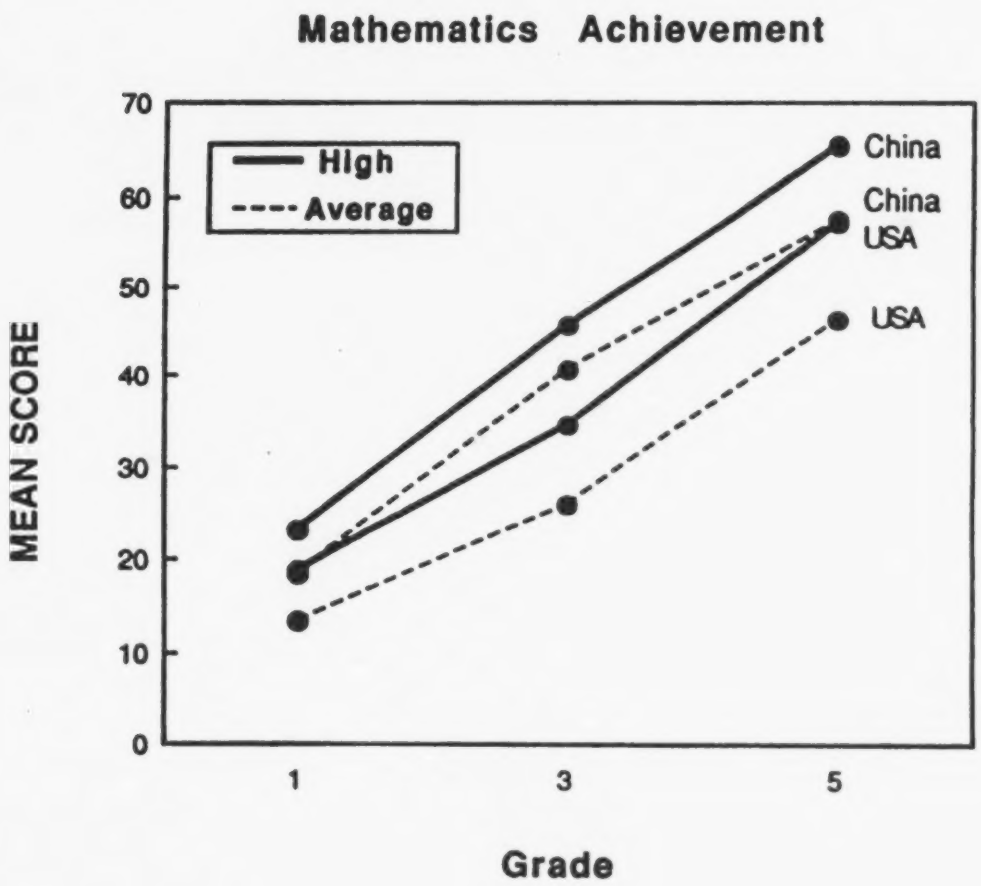
Figure 4.— Mean standard (z) scores on the mathematics test of groups of kindergarten, 1st-, 5th-, and 11th-grade students in Taipei, Sendai, and Minneapolis who received high and average scores on the mathematics test.



more in Taipei and Sendai than in Minneapolis in their educational levels. At the eleventh grade, for example, the difference in years of education for Minneapolis fathers was only half a year, but was 2.3 years in Taipei and 1.3 years in Sendai; for mothers the corresponding differences were 4, 2.5, and .8 years. Thus, while the socioeconomic status of the home as indicated by parents' education was greater in all cases for the high achievers than for the average students, it played a potentially much stronger role in the East Asian families.

Classrooms and schools. If all of the high-scoring elementary school students came from only a few

Figure 5.— Mean standard (z) scores on the mathematics test of groups of first-, third-, and fifth-graders in Beijing and Chicago who received high and average scores on the mathematics test.



of the 20 classrooms at each grade in each location, our findings might be attributable to the effects of a few teachers or to ability grouping. This was not the case. High achievers came from 13 or more of the 20 first-grade classrooms and from 12 or more of the 20 fifth-grade classrooms in each location. In none of the cities, therefore, was high achievement in elementary school attributable to a small number of especially skilled teachers or to other characteristics of a few classrooms.

The picture is much different at eleventh grade. In Japan, 83.1 percent of the students came from two of the eight schools involved in the study; in Taiwan, 82.1 percent of the high achievers came from five of the eighteen schools. Thus, the dispersion of high achievers among different schools during the elementary school grades was replaced by a much higher concentration of high-achieving

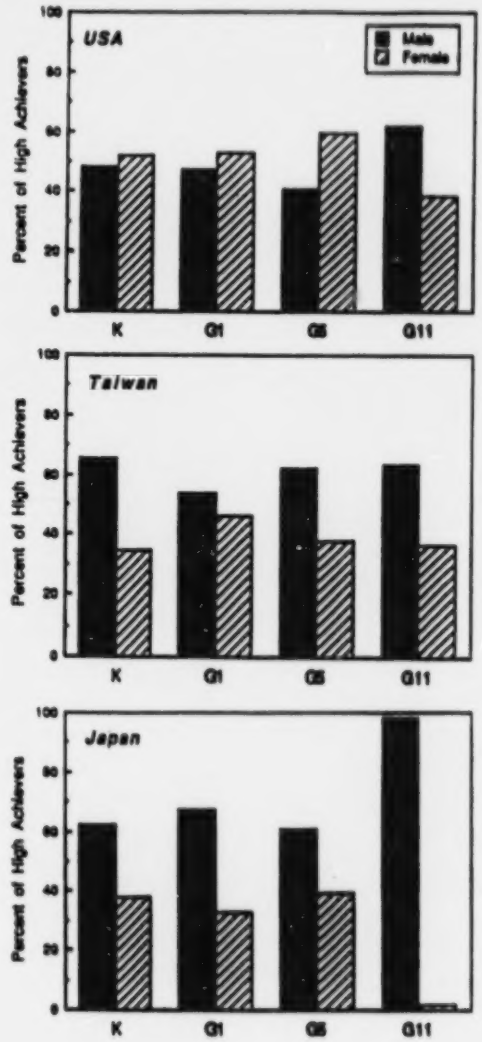
eleventh-graders in a small number of high schools. As we noted earlier, a hierarchy of high schools exists in Taiwan and Japan that is defined by the severity of the entrance requirements imposed upon the students. It is not surprising, therefore, that the greatest number of high achievers came from the most highly rated high schools.

The concentration of students in a few schools was somewhat less in Minneapolis, where 66 percent of the high achievers in mathematics came from three of the nine schools involved in the study. Although there are differences among American high schools in any large city in the quality of instruction and the students' abilities, a clear hierarchy produced by different entrance requirements does not exist.

Longitudinal Data. Because we followed the first-graders until they were in eleventh grade, we can ask how the high achievers in mathematics at first grade scored when they were in eleventh grade. The eleventh-grade percentile scores in mathematics for the high-achieving Minneapolis first graders was 77.7; for the high achieving Taipei students, 68.3, and for Sendai students, 86.2. These data indicate that the top-scoring first graders were likely to continue to do well in mathematics throughout their schooling.

But was the reverse true? Were the top achievers in mathematics at eleventh grade also high achievers at first grade? To answer this question, we looked back at the first-grade mathematics scores of the students who were in the top ten percent of the students on the eleventh-grade mathematics test. In all three cities the high achieving eleventh graders were found to be above average at first grade. The mean percentiles of first grade mathematics scores for Minneapolis, Taipei, and Sendai students were 79.8, 72.1, and 85.2. In general, therefore, the top students in eleventh grade were much above average according to tests given approximately six months after they entered first grade.

Figure 6.—The percentage of boys and girls in kindergarten, 1st-, 5th-, and 11th- grades that received high scores in mathematics in Minneapolis, Taipei, and Sendai.



Correlates of High Mathematics Achievement

We looked further at factors that differentiated high achievers from their average-performing

peers. Both in-school and out-of-school factors were considered, but our major interest was in how high levels of achievement are related to cultural values about education, parents' attitudes and beliefs about children's development, and scholastic performance.

First and Fifth-Graders

Cognitive ability. Replicating the finding that academic achievement differs according to students' cognitive ability is not especially useful, but it is of potential value to know whether the patterns of abilities of high achievers were similar among the three cultures.

Scores in all cultures differed on nearly all of the tasks between the high and average achievers. The only exceptions were for the rote memory and perceptual tasks (Uttal, et al., 1988). Not surprisingly, it was the more complex cognitive tasks that emerged as the best discriminators of performance in mathematics. Multiple discriminant function analyses of the data for the high achievers at each grade and in each city revealed that tasks such as verbal-spatial representation (identifying and drawing spatial patterns on the basis of verbal instructions), verbal memory (recalling the details of a short story), vocabulary, and general information were the strongest predictors of mathematics achievement. Although the patterns of these tasks were not identical in each location, we did not find a set of abilities related to high levels of achievement that was unique to any location.

Self-evaluations. Fifth-grade students in the 1990 study were asked to make their own evaluations of their levels of academic achievement, intelligence, and performance in mathematics. The high achievers did not rate themselves as being truly outstanding. In Taipei and Sendai they did give themselves ratings that were higher than those of the average students, but not in Minneapolis. The self-ratings of average students were as high as those made by the high achievers (see figure 7).

The lack of self-insight of the average American fifth-grade students may be a result of the lack of information available to students in American schools. The relative standing of all students is common knowledge among students in the classrooms of East Asia; scores on all important tests are reported publicly. This rarely occurs in American schools. Grades are available only to the individual student, and even then they may be disclosed in such general terms that the students are not aware of their actual standing in the class. Report cards in American elementary schools typically offer global evaluations, such as "satisfactory," while East Asian schools provide numerical grades. Because of this, it may be more difficult for average students to gain an accurate estimate of their relative status in American than in Asian elementary schools.

Attributions. The Confucian emphasis on the malleability of human beings and the perfectibility of human behavior through proper experiences continues to have a pervasive influence in Chinese and Japanese cultures. This was evident in the discussions we described earlier, and in the results of our research. We have found, for example, that Chinese and Japanese mothers, teachers, and students are more likely than their American counterparts to attribute success in school to hard work (Stevenson, et al., 1990), and less likely to attribute it to innate ability. Would these tendencies be exaggerated by high-achieving students? Would high-achieving Chinese and Japanese students give even more emphasis to hard work, and high achieving American students give even more emphasis to the importance of innate ability?

Evidence related to this question was obtained from fifth-graders. We asked the students to rate their agreement with statements such as "You can be good at any type of math problem if you work on it hard enough," "Natural ability is more important than effort for doing well in math," and "Everybody in your class has about the same amount of ability in math." The major finding was that high achievers in Taiwan and Japan were more likely than average achievers to attribute success to the attributes most favored by their

Figure 7.— Self-evaluations of their academic achievement, intellectual ability, and mathematics ability of fifth-graders in the high- and average-achieving groups.

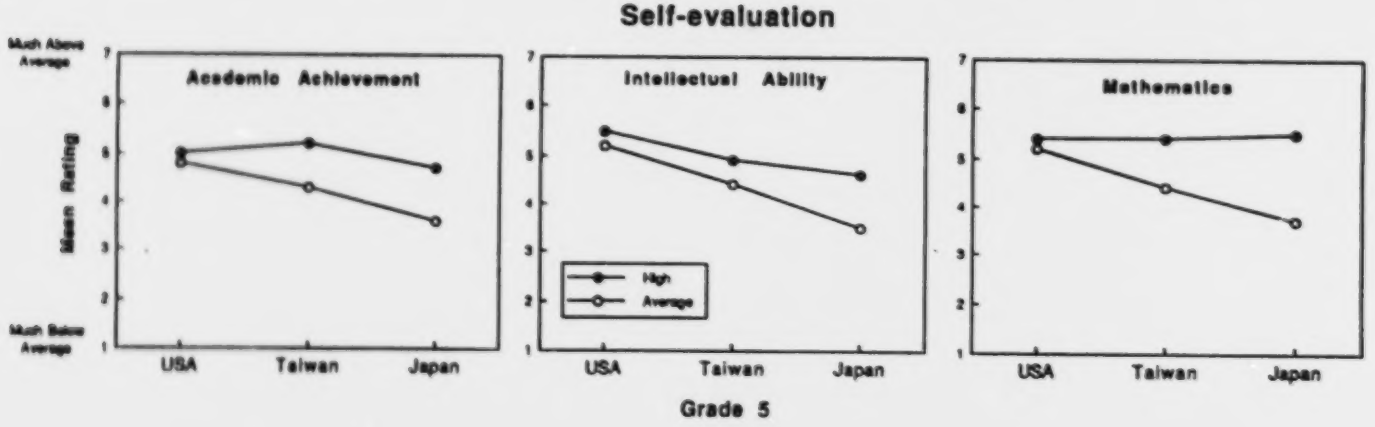
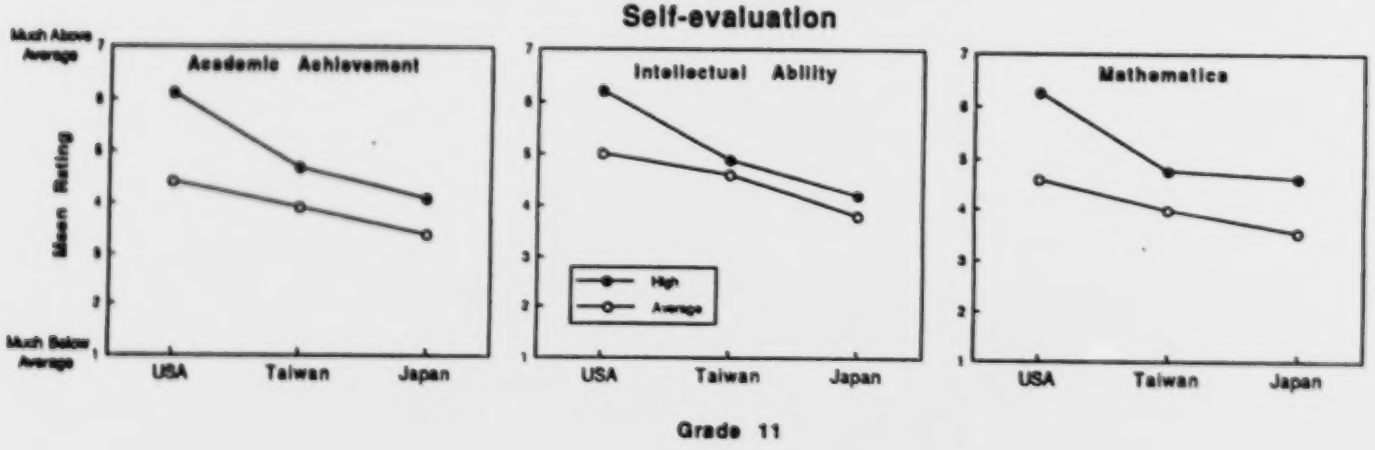


Figure 8.— Self evaluations of their academic achievement, intellectual ability, and mathematics ability of 11th-graders in the high- and average-achieving groups.



culture: they emphasized the importance of hard work and de-emphasized the contribution of- innate ability. Findings for the American students were less consistent. The average students were more likely than the high achievers to believe that hard work would lead to success, but they also gave stronger emphasis to the importance of innate ability (see table 2).

High School Students

Some of the questions asked of high school students were the same as those asked of the younger students. The responses to several of these questions yielded some interesting new insights into the personality and motivation of high achievers in high school.

Self-evaluations of Achievement and Intelligence. Eleventh grade high achievers, like their fifth-grade counterparts, were aware of the fact that they were doing well in school (see figure 8). American students were the most positive about themselves and Japanese students, the least. However, in contrast to the younger students, where the Minneapolis high achievers and average students gave themselves similar ratings, the Minneapolis high school students who were average achievers in mathematics did give themselves lower ratings than did the high achievers.

Table 2.—Attributions made by average and high achievers in fifth grade

	United States		Taiwan		Japan	
	Average	High	Average	High	Average	High
Everyone has the same amount of ability in math.	3.6	2.7	4.7	3.6	4.0	3.7
Anyone can be good at math if they work hard enough.	6.2	5.7	5.9	6.2	5.6	6.6
Natural ability is more important that effort for doing well in math.	4.0	2.7	2.9	2.6	3.6	3.2

Note: 1 = Strongly disagree; 7 = Strongly agree.

Other psychological characteristics. There were many other characteristics for which the high and average achievers gave themselves similar ratings. These included physical appearance, ability to get along with others, having good family relations, caring about others, wanting to study rather than having fun, not wanting to skip school, and not feeling satisfied with just a passing grade.

Attributions. One of the areas of greatest difference between the responses of the elementary school and high school students was in their attributions concerning the bases for academic success. Whereas the responses of the high achievers and average elementary school students differed from each other, the responses of the high and average achievers in high school were small or insignificant. The average high school students were more likely to believe that anyone could be good at math if they worked hard enough, but differences between ratings made for other statements were not statistically significant.

Indices of Stress. One domain we were able to explore with high school students that we could not investigate with young children was their level of stress. Parents and teachers often worry that high achievement may come at the cost of an increased incidence of psychological disturbance. We have not found this to be the case in analyses of eleventh graders in Taipei, Sendai, and Minneapolis, even though their levels of achievement differed greatly. Nor did we find it to be true of the high and average achievers in each city. In fact, if anything, it was the average achievers, not the high achievers, who were likely to describe indications of tension.

We asked the students to indicate the frequency with which they experienced a large variety of disorders, such as feeling tired, having problems with sleep, eating, and elimination, and having headaches and stomach aches. The average students in all cultures reported significantly more frequent headaches, stomach aches, and diarrhea than did the high achievers. They also indicated

that they were more anxious about keeping up with their schoolwork, and the Sendai and Minneapolis average achievers reported feeling more frequent anxiety while they were taking tests and when their tests were returned. Average students were also more frequently angry at their teacher, and in Minneapolis they reported feeling like hitting someone or destroying something more often than did the high achievers. High achievers in Sendai reported these aggressive feelings more often, but the frequencies for the high and average achievers did not differ in Taipei.

There was not a significant difference between high achievers and average students in the frequency with which they reported feelings of stress, but high achievers in Minneapolis did report more frequent feelings of depression. In Sendai and Taipei, however, high achievers reported feeling depressed less frequently than did the average achievers.

Reasons for studying hard. Another new area that we were able to explore with high schools students was the basis of their motivation for studying hard. High achievers were more likely than average achievers to believe that they studied hard because they wanted to gain more knowledge, to go to college, and because they set high standards for themselves. In contrast, the average achievers were more likely than high achievers to say they studied hard to please their parents and teachers, and because they had no other choice (see table 3).

Table 3.—Importance of various reasons for studying hard for eleventh-grade students

	United States		Taiwan		Japan	
	Average	High	Average	High	Average	High
Gain more knowledge	5.1	5.7	5.0	5.5	4.6	5.2
Go to college	6.2	6.1	5.5	6.2	5.4	5.6
I set high standards for myself	5.2	6.1	4.9	5.8	4.2	4.5
Please my parents	5.1	4.3	4.9	4.9	4.1	3.2
Please my teachers	4.2	3.3	3.3	3.0	2.9	2.5
I have no other choice	3.2	2.3	3.2	2.7	3.6	3.4

Note: 1 = Not all important; 7 = Very important.

In other words, the motivation of high achievers for studying hard lay within themselves, but for low achievers it was more likely to depend on external factors.

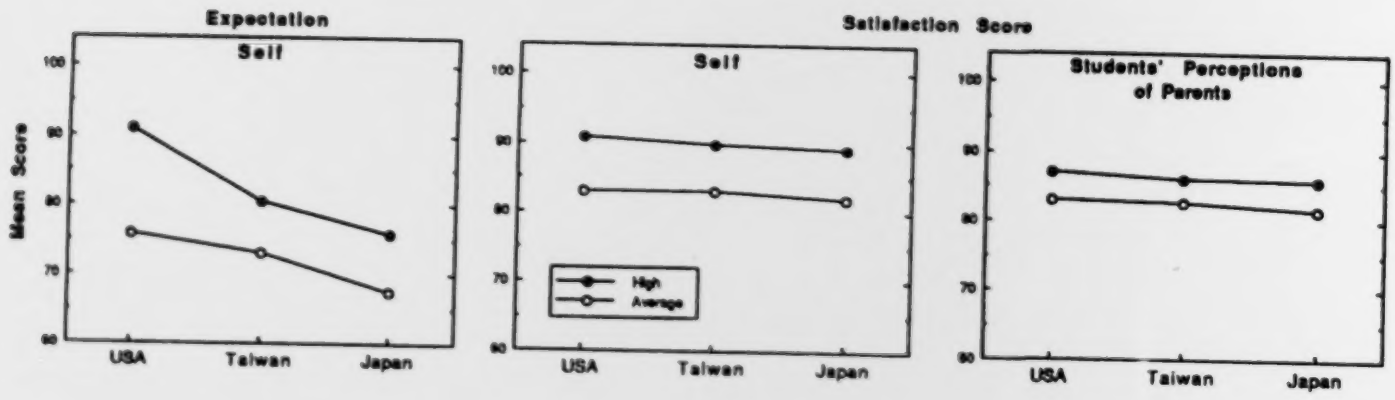
Additional evidence of the self-motivation of high achievers appeared in the students' ratings of the importance of getting good grades. We asked the students first to rate the importance for their parents and then for themselves. High achievers considered it more important to themselves to get good grades than they believed it to be to their parents. The average achievers thought it was equally important to their parents as it was to themselves to get good grades.

Expectations and Satisfaction. Another approach to exploring students' motivation for studying hard is to compare how well they expect to do on an examination with what they would consider satisfactory. We told the students: "Let's say there is a math test in which there are 100 points. The average score in your class is 70. What score do you think you would get? What score would you be satisfied with? What score would your parents be satisfied with? The results are summarized in figure 9.

In all comparisons there were significant differences between the estimates made by the high and average achievers. The average students expected to get a score around average; the high achievers, especially the Americans, expected to do much better.

Three interesting phenomena appeared in the satisfaction scores. First, the scores with which students in each culture would be satisfied were remarkably similar, as were the estimates of the scores with which they believed their parents would be satisfied. Second, there was a much greater discrepancy between what both the high and average achievers in Taipei and Sendai expected and what they would be satisfied with than was the case for American students. These results help to explain why the Chinese and Japanese students perform so much more effectively in academic achievement than do American students. American

Figure 9.— Mean score on a hypothetical mathematics test by groups of high- and average-achievers in mathematics, the score they would find satisfactory, and the score they believed their parents would find satisfactory.



students set standards for themselves that did not depart greatly from their expectations. Chinese and Japanese students set standards for themselves that were higher than the ones they expected to attain. Third, the high self-motivation of high-achieving students is evident in the fact that they set higher standards for themselves than they believed their parents would impose.

Summary and Conclusions

Programs for gifted and talented children in East Asia are new; the majority were established during the last decade. The most vigorous efforts are being made in China and Taiwan. China, with its need to modernize, and Taiwan, aware of its delicate economic position as a result of scarce natural resources, have promoted education as a means of advancing their societies. In this effort, the governments have introduced a wide array of programs for gifted and talented students during the regular school day and after school. Japan supports no programs specifically for gifted students prior to the high school years.

Political philosophy is obviously not a critical factor in determining whether programs for gifted students will be established. The socialist government of China promotes egalitarianism, but it also believes that well-trained scientists, mathematicians, and other professionals are important for the advancement of the country. The government assumes that the best way to develop such individuals is to nurture students who give evidence of outstanding abilities. Japan, on the other hand, had bitter experience with social elitism before World War II, and since then has taken vigorous steps to avoid the emergence of groups that would dominate the political and social life of the country. As a result, Japan makes strong efforts to ensure that all children begin school with equal knowledge and receive equal educational opportunities during their elementary school years. The Japanese explain that some children emerge as more effective students than others, but this occurs not because of their exceptionally high innate abilities or high social status, but because they have taken advantage of their opportunities and worked hard in school. Thus, high schools serving only highly able students are justified because these students have already shown that they are more likely to benefit from a more demanding curriculum than their average peers.

As far as we can tell from many hours of observations in the schools of China, Taiwan, and Japan, the formal policies are carefully adhered to by educational administrators and teachers. There is no denial of innate differences in ability, but in both Chinese and Japanese cultures, emphasis is placed on the importance of effort as the ultimate factor that differentiates the level of achievement individuals attain. 'The slow bird must start out early,'' say the Chinese. ''Yareba dekiru,'' say the Japanese: ''If you work at it you can do it.'' These are optimistic beliefs, and underlie the expectation that all normal children are capable of performing effectively in school. The secret of academic success lies in having devoted teachers and supportive parents-but most importantly in the hard work of the students themselves. Chinese and Japanese educators and psychologists tell us they cannot understand why Westerners place such importance on innate abilities. They consider this a self-defeating emphasis, one that potentially limits the'' achievement of average and gifted students alike. Average students may begin to doubt that they can succeed even if they do work hard, and gifted students may come to believe that their high abilities alone are sufficient for ultimate success.

A common question about effort-oriented philosophies is how gifted students continue to be motivated to study. Gifted students in China and Taiwan have many opportunities to work at levels beyond those demanded by the standard curriculum. It is a potential problem in Japan, where no special academic opportunities other than *juku* are typically available to gifted children.

Gifted Japanese students remain highly motivated in their regular classrooms for several rea-

sons. First, Japanese teachers use an interactive teaching technique, where they attempt to elicit information from students, rather than providing it themselves through frequent lectures. In seeking information from the class, teachers allow gifted students to share innovative ideas and explanations with their classmates. Further, classes in elementary schools are divided into *han*, small, heterogeneous groups that work together on problems. The more advanced students in the *han* assist other students who may be having difficulty. By high school, gifted students are separated into different schools in accordance with their level of academic achievement. During the high school years all Japanese students are intent upon doing well on college entrance examinations and know that the best way to do well is to master the high school curriculum.

The most notable finding in our comparative research is how similar the bright and high achieving students are in the different cultures in which we conducted our research. Only rarely was the degree of difference between students in the high scoring groups and those receiving average scores dependent on a particular culture. There were no especially outstanding characteristics that distinguished gifted and talented East Asian students from their American peers, except for their marked superiority in mathematics achievement.

Schools in East Asia are producing some remarkable students. Although there is no indication that their general level of intelligence is higher than that of students in the West, their level of sophistication in mathematics is well beyond that found in the United States and other Western countries.

We found, not surprisingly, that the bright students in first grade did well in high school. Conversely, students who did well in high school tended to be ones who received high scores on cognitive tasks in elementary school. The same type of results were found for mathematics achievement. The relationship was not perfect in either case, which leads us to wonder what happened to the children who did very well in mathematics in first grade but did not do well in high school, or to those who did very well in mathematics in high school but did not do well in first grade. What might account for the fact that of the very top achievers among the thousand eleventh-grade Minneapolis students, one received the top score at first grade, while another was over a standard deviation below the mean of all Minneapolis first graders?

The dominance of boys among the high achievers in mathematics in Japan, Taiwan, and China is in line with the preferred position of males in East Asian society. Similarly, the dominance of boys in American high school mathematics classes is undoubtedly related to their more frequent appearance among the high achievers. The unusually large proportion of boys among the high achievers at eleventh grade in Japan was not expected, but may reflect the fact that boys are more likely than girls to strive for admission to science and engineering departments of the leading universities and may work harder in mathematics.

As might be expected, the students and their mothers were generally aware of the relative status of high-scoring and average students. This was true in the East Asian societies that attempt to de-emphasize individual differences among children and in the United States, where individual differences are a matter of great interest. One exception occurred in Minneapolis. The average American elementary school students and their mothers generally considered the students to be more outstanding than was justified by their test scores. It seems likely that this is due, in part, to the lack of comparative information and more global evaluations received by American students.

We found that high achievers in Taiwan and Japan subscribed to the explanations for success favored by East Asian cultures more frequently than did the average students, but that the difference disappeared at eleventh grade. We know of no other developmental study of attributions made by high achieving and average students in East Asia; thus it is difficult to interpret the significance of these developmental changes.

We also found no evidence that high achievers experience greater stress than average achievers. From the self-ratings of nearly 400 high achievers in this study, we found infrequent indications of anxiety, tension, psychosomatic disorders, or other indications of poor adjustment. In fact, when differences between gifted and average students were found in this domain, the average students reported the greater stress.

High achievers appeared, however, to be much more self-motivated than were the average achievers. They were less dependent than average achievers on outside influences in getting them to study and to get good grades, and they set standards for themselves that were higher than those they believed would be set by their parents. Although the highly able American students suggested the highest scores when asked about the score they would expect to receive on a hypothetical test, high achievers in all three cultures made similar estimates of the score with which they would be satisfied. These data give us some insight into the reasons why East Asian students study harder than their American peers. If standards do not exceed the individuals' expected level of achievement, there is little reason for increasing effort. On the other hand, if a satisfying score is above what the individual expects to achieve, there is reason to persist. This prediction is supported by the students' reports of how much they study mathematics each week. Whereas the American eleventh-grade high achievers reported studying mathematics after school only a little more than three hours a week, both Chinese and Japanese high achievers reported that they studied mathematics after school more than six hours a week.

From this survey it appears that neither level of economic development nor the quality of schools and universities determines whether or not programs for the education of gifted and talented students will be established in any particular country. The critical difference is the culture's philosophy of education. In an effort to promote egalitarianism, all elementary school students in Japan are required to remain with their classmates regardless of their level of intelligence or of academic achievement. In contrast, Taiwan and China, seeking to enhance the contribution of gifted and talented students to their societies, have developed elaborate programs of special education. The natural experiments that are taking place in these cultures will provide information about gifted and talented students that will be of interest throughout the world.

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Notes

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[3] For ease of reading we will not indicate the results of statistical tests in this report; however, all of the differences we describe were statistically significant.